SIAG Analysis of Partial Differential Equations
(APDE) Charter Renewal Application

This CHARTER RENEWAL applies to the SIAM Activity Group on Analysis of Partial Differential Equations (SIAG/APDE). The SIAG/APDE was originally formed under the aegis of SIAM on March 26, 2003 by the SIAM Council and on December 7, 2002 by the SIAM Board of Trustees. Its initial operating period began April 2003 and ended December 31, 2004. Its charter has been renewed by the Council and Board eight times thereafter.

This SlAG had 928 members as of December 31, 2019; 615 (66.3%) were students and 313 (33.7%) were not students. Of the nonstudent members 64 (20%) were female, and among the student members 156 (25%) were female. A total of 66% of the membership (22% nonstudents and 44% students) were from the US. The membership of this SIAG reflects an overwhelming academic presence, 92.1%.

According to its Rules of Procedure, the objective(s) of the SIAG are:

It is the purpose of the SIAG/APDE to foster activity in the analysis of partial differential equations (APDE) and to enhance communication between analysts, computational scientists and the broad APDE community.

Its goals are:
- To provide a forum where researchers in the area, theoretical and applied, can meet;
- To be an intellectual home for researchers in the analysis of APDE;
- To increase conference activity in APDE;
- To enhance connections between the applications and analysis communities. In particular, to foster interdisciplinary research that stems from analysis of PDE.

Within the framework of SIAM, the SIAG will conduct activities that implement its purposes.

The SIAG/APDE will undertake a number of activities, including:

1. Organize a biennial SIAM Conference on Analysis of PDE. Because of connections between PDE and the topics of many of the other SIAGs, the SIAG/APDE will also solicit opportunities to run joint meetings with other SIAGs and with other periodic SIAM meetings (for example, Materials Science, Nonlinear Waves and Coherent Structures, and Computational Science and Engineering). The chair of the conference organizing committee shall be either the program director or the chairperson of the SIAG or their designee. The organizing committee must be approved by the VP for Programs at least 16 months before the conference.

2. Disseminate information. The SIAG will maintain a website to facilitate the exchange of information (conferences, summer schools, job announcements) among its members and other interested parties.

3. Award the SIAG/APDE Prize, established in 2005, to the author(s) of the most outstanding paper, as determined by the Prize Selection Committee, on a topic in Partial Differential Equations published in English in a peer-reviewed journal bearing a publication date within the four calendar years preceding the year of the award.

Award the SIAG/APDE Early Career Prize. This prize will be awarded every two years to an early career researcher who has made outstanding, influential, and potentially long-lasting contributions within six years of receiving the PhD or equivalent degree as of January 1 of the award year. At least one of the papers containing this work must be published in English in a peer-reviewed journal or conference proceedings.

4. Organize minisymposia at the SIAM Annual Meeting in years where there is no SIAG conference.

5. At least once every seven years either organize a track of at least six minisymposia at the SIAM Annual Meeting or have an activity group meeting held jointly with the annual meeting. The VP for Programs and the VP at Large will coordinate the scheduling with the SIAG chair.

6. With the approval of the SIAM Program Committee, the SIAG may organize special sessions at SIAM meetings, and conduct special one- or two-day meetings immediately before or after a regular SIAM meeting. Other SIAG meetings may be organized only with the approval of the SIAM president and vice president for programs.

SIAG meetings, workshops, and conferences may be organized only with the approval of the SIAM president and the SIAM vice president for programs.

The SIAG has complemented SIAM's activities and supported its proposed functions. The answers to the questions below indicate how this was accomplished and what the officers propose as the future directions for the SIAG.

1. **List all current officers of the activity group.**

Chair: Irene Fonsea
Vice Chair: David Ambrose
Program Director: José Carrillo
Secretary: Cleopatra Christoforou

2. **How is the field covered by the activity group doing? Is it growing, is the focus shifting? What have been the significant advances over the last two years?**

The activity group APDE represents a diverse community with interests in a wide variety of fields related to Analysis and Partial Differential Equations. It fosters interactions between theory and computation, and it encourages the dialog with neighboring disciplines to enhance interdisciplinary activities. Applications of analysis and (local and nonlocal) partial differential equations are driving the broadening of these areas into probability, new trends in kinetic theory and fluid mechanics, with new emphasis on imaging, mean field games, and the emerging mathematics of machine learning and artificial intelligence.

We awarded the 2019 SIAG APDE Best Paper Prize to Jacob Bedrossian and Nader Masmoudi for their paper, "Inviscid Damping and the Asymptotic Stability of Planar Shear Flows in the 2D Euler Equations", recognizing the preeminence of the activity group in this research area. Further, the variety of topics addressed in the 102 mini-symposia sessions, 98 contributed lecture presentations and 27 contributed poster presentations held at the SIAM Conference on Analysis of PDE in December 2019 in La Quinta (CA) attests well to the vibrancy of this SIAG's activities. The minisymposia covered highly active areas of applied analysis such as Nonlocal PDEs, Kinetic Theory, Conservation Laws, Coupled Multi-Physics PDE Systems, Fluid Dynamics, Numerical Analysis of PDEs, Control and Optimization, Variational Methods, Nonlinear Waves, Stochastic PDEs, PDEs in Biological and Complex Systems, Multiscale Analysis, Geometric PDEs and Optimal Transport, Mathematical Physics. The selected applications of PDEs in this occasion included Biology, Medicine and Imaging, PDEs on Graphs and Networks and Geophysical Flows. There were two minitutorials, reflecting hot topics in PDE, one on new applications of PDEs in Data Science, delivered by Andrea Bertozzi (UCLA) and Yves Van Gennip (Delft University), and the other on Population Dynamics in Mathematical Biology, delivered by Mark Lewis (University of Alberta). There were 9 plenary lectures, spanning some of the most active topics in the field and new interactions with nearby areas, including the prize lecture referred above. Overall, the conference was a huge success.

3. **How is the activity group doing? Is it remaining vibrant? Is the size of the SIAG stable or increasing? How is the SIAG keeping up with the changes in the field? How are the broader interests of SIAM reflected in the activities of the SIAG?**

The SIAG/APDE is the fifth largest SIAM activity group has achieved membership numbers in the middle-to-upper range of SIAM activity groups, following CSE, DS, DMA and OPT, and comparable LS and UQ. One feature that distinguishes this activity group, except for the SIAG ED, in the large percentage of student membership, 66.3%. This number is still increasing, with 57.9% in 2017 and 64.5% in 2018. Having this large representation of students is a strong sign of the relevance of contemporary areas that this activity group covers. However, why many of these students do not, eventually, become members is a question for further investigation. Interesting also is the fact that these numbers are not reflected in the conference participation: the average of the past 8 meetings, including pre-registrations, shows 77% non-students vs 23% students.

The number of female members, 64 nonstudents (20% of the nonstudent members) and 156 students (25% of the student members) has increased considerably since 2018, with 59 (16.9%) and 84 (16.9%) respectfully. This is a good trend but more needs to be done to address gender diversity of this SIAG. Geographic diversity is solid (see the charts below), although the diminutive representation of industry and laboratories is a matter of concern. We should consider implementing strategies to address this, e.g., by having plenary/invited speakers from these cohorts also organizing minisymposia.

Below we present bar charts and pie charts with statistics concerning conferences attendance and the SIAG's membership.
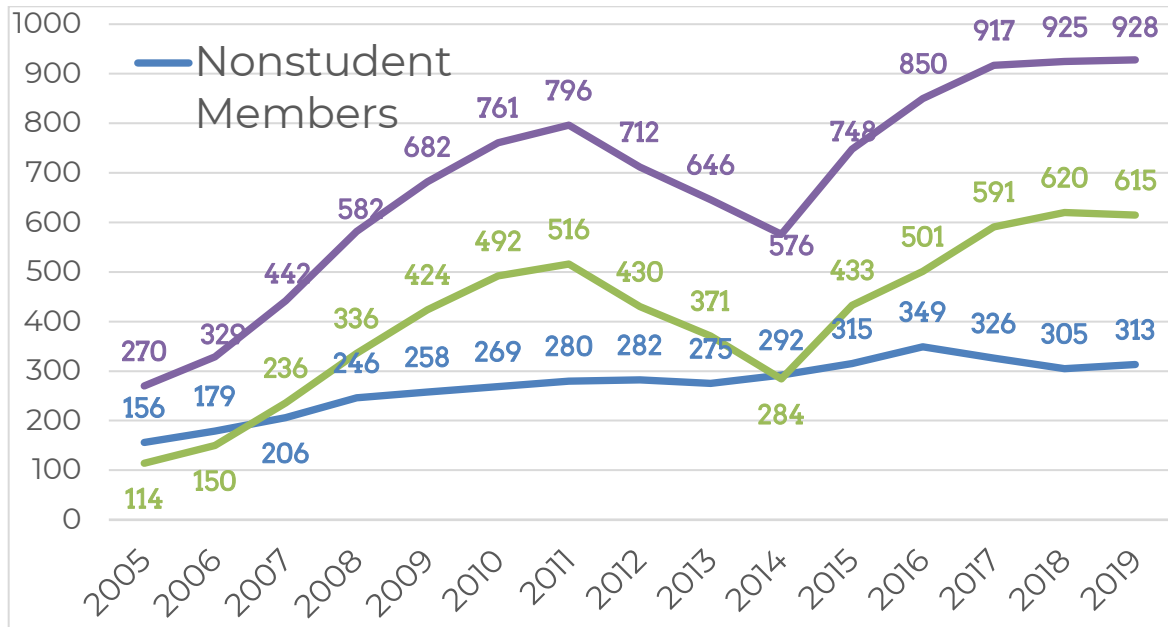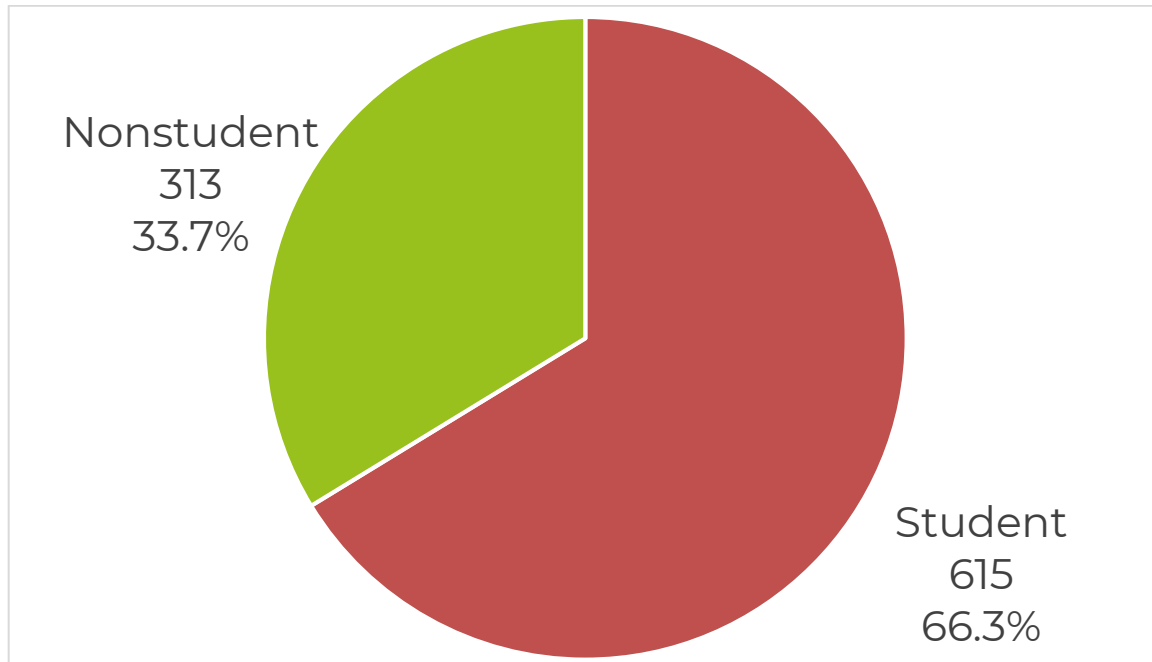
SIAG/APDE Conference History
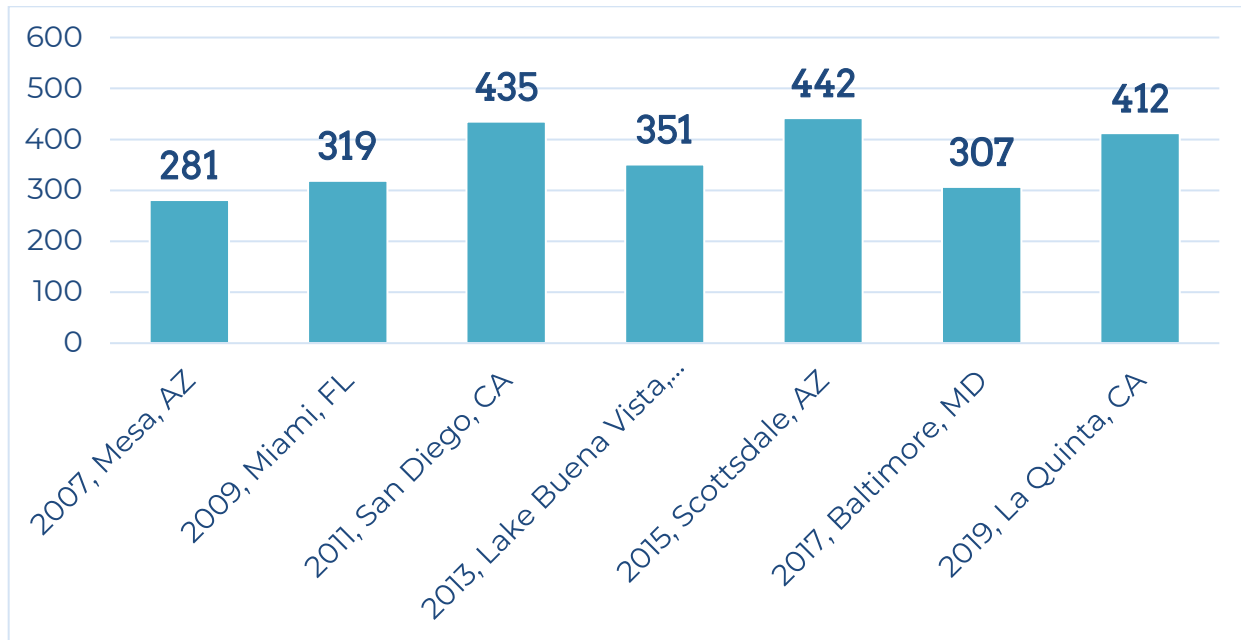
SIAG Overall Membership
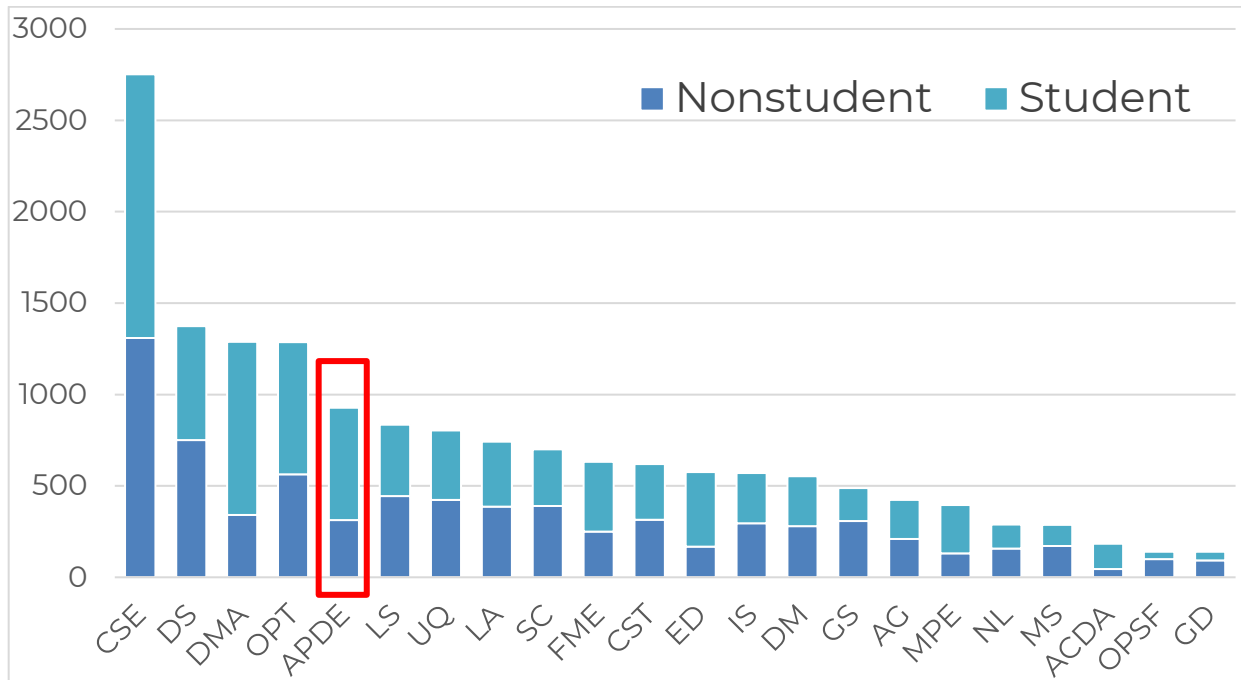
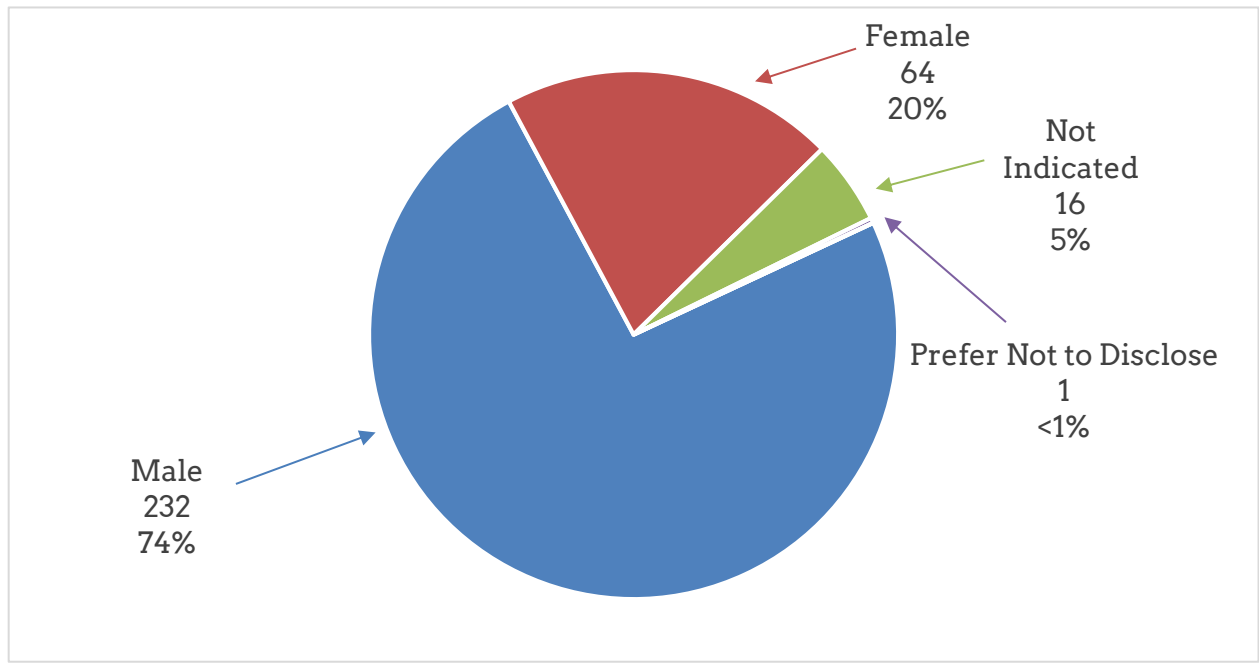## SIAG/APDE Membership Demographics

SIAG/APDE Membership Demographics

SIAG/APDE Membership by Geography

	Nonstudent		Student		Total	
US	200	22%	411	44%	611	66%
Non-US	113	12%	201	22%	317	34%
Total	313	34%	615	66%	928	

SIAG/APDE Membership by

Nonstudents

Female
64
20%

Not
Indicated
16
5%

Prefer Not to Disclose
1
<1%

Male
232
74%

Students

Female
156
25%

Not
Indicated
66
11%

Prefer Not to
Disclose
2
<1%

Non Binary
2
<1%

Male
389
63%
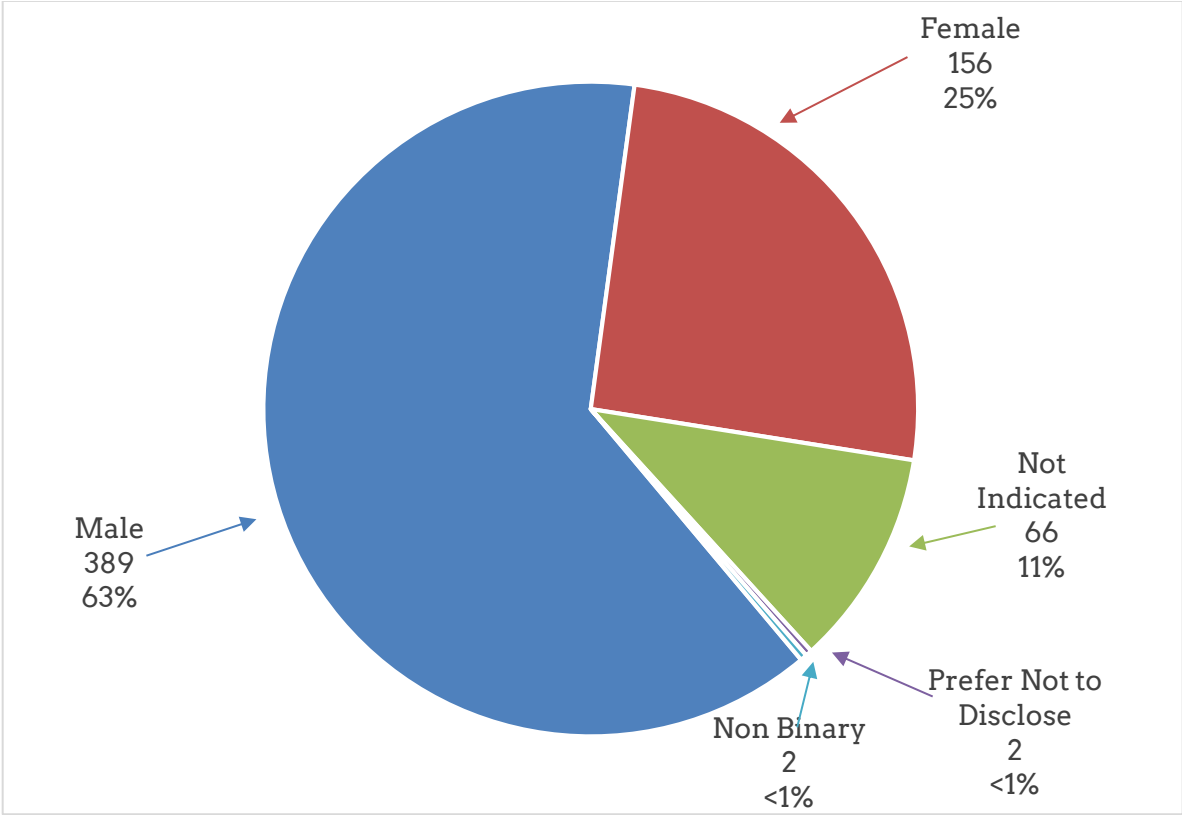
SIAG/APDE Membership by Employer Type

Industry
12
4.3%

Laboratory
5
1.8%

Government
5
1.8%

Academia
257
92.1%
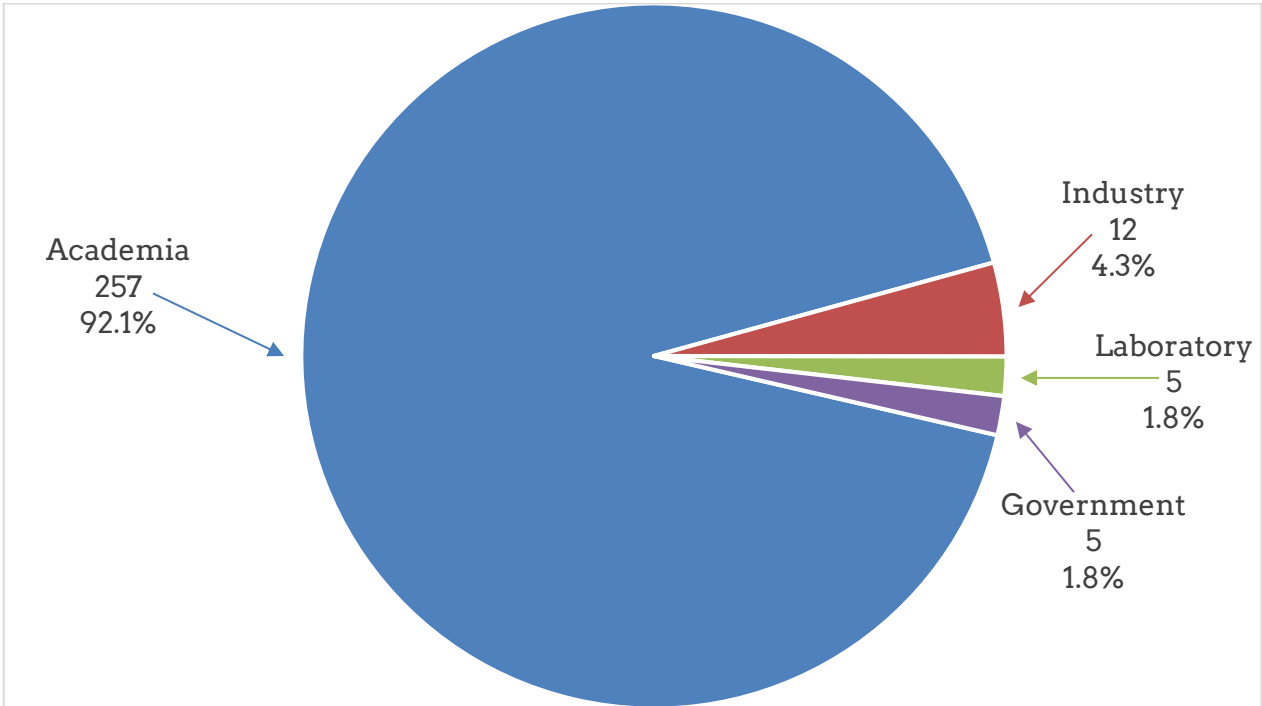
SIAG/APDE Membership by Department

Engineering
11
7.3%

Other
2
1.3%

Statistics
1
<1%

Mathematics
137
90.7%
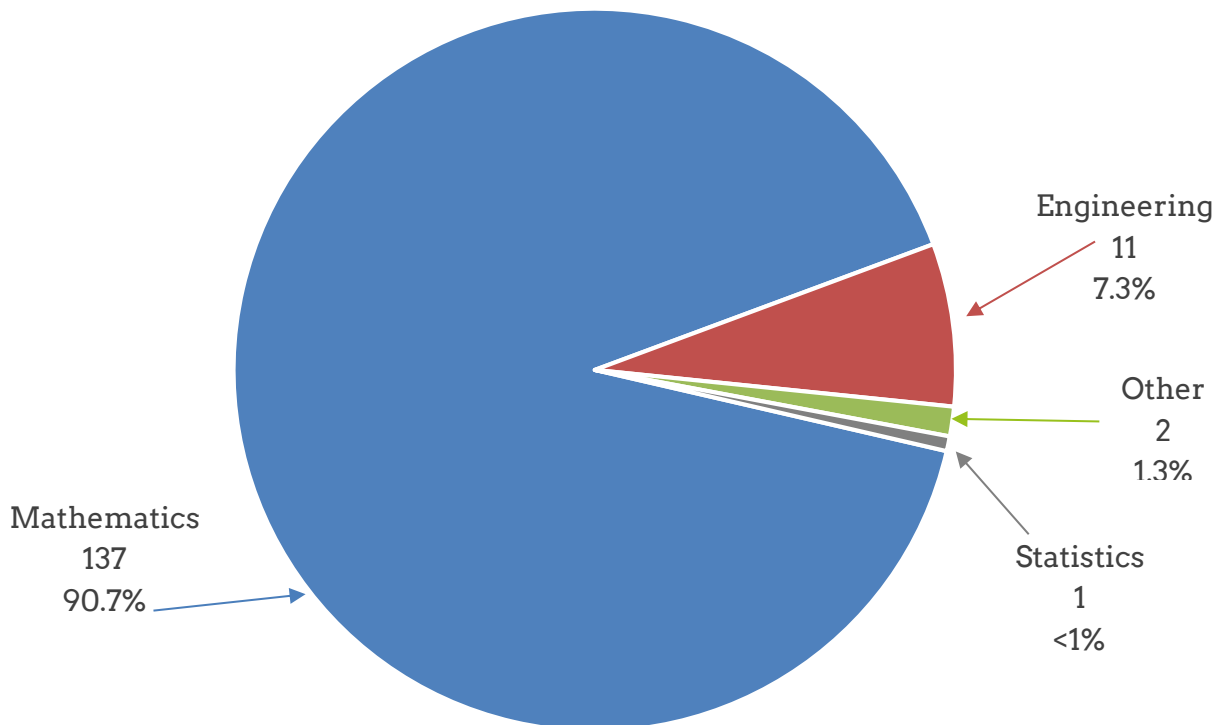
4. Please list conferences/workshops the activity group has sponsored or co-sponsored over the past three years and give a brief (one sentence or phrase) indication of the success or problems with each. The SIAG APDE organizes the biennial conference on Analysis of Partial Differential Equations.

A list of conferences may be found at https://www.siam.org/membership/activity-groups/detail/analysis-of-partial-differential-equations

The SIAG APDE organizes the biennial conference on Analysis of Partial Differential Equations. The 2017 meeting took place at the Baltimore Convention Center, December 8th to 12th. It consisted of eight plenary talks, the SIAG prize lecture, sixty-eight minisymposia and eleven contributed talk sessions. The minisymposia and contributed talk sessions were held on up to twelve parallel sessions. In addition, the meeting hosted the SIAG-APDE business meeting and a meeting of the Editorial Board of SIAM Journal on Mathematical Analysis. Scientific activity retained the usual high standards for this conference. There were 307 registered participants. The 2019 meeting venue was in La Quinta (CA) and counted with 412 registered participants.

The 2019 meeting venue was in La Quinta (CA) and counted with 412 registered participants, which is a large increase with respect to the two previous editions of this event. This great success has been partially achieved by enlarging the basis of attraction of the conference. More precisely, the mechanism thought by the co-chairs of the La Quinta PD19 conference was opening up this SIAM series of conferences to other topics in PDEs and by fostering new and

old interactions of PDEs with nearby areas such as Calculus of Variations, Mathematical Biology, Data Science, Applied Dynamical Systems, Mathematical Physics and Scientific Computing. This strategy partially influenced the choice of the plenary speakers.

5. **Please indicate the number of minisymposia directly organized by the activity group at the last two SIAM annual meetings. When did the SIAG last organize a track at an annual meeting or meet jointly with the SIAM Annual.**

It seems that the last time APDE organized a track at the Annual Meeting was 2016. Both 2017-2018 and the 2019-2020 Program Directors were not aware that this SIAG could or should directly organize minisymposia at the SIAM annual meeting. Several members of this SIAG had organized minisymposia for AN20, however, not under the SIAG/APDE label. APDE will look into organizing a track at Annual Meeting over the next officer term.

6. **Please indicate other activities sponsored by the activity group, to include newsletters, prizes and web sites. Have each of these been active and successful?**

The SIAG/APDE awards the SIAM Activity Group on Analysis of Partial Differential Equations Prize. The prize was established in 2005 and it is awarded to the author(s) of the most outstanding paper, as determined by the prize committee, on a topic in partial differential equations. The SIAG/APDE Prize is awarded at the biennial Conference on Analysis of PDE. It was awarded in 2019 Jacob Bedrossian (University of Maryland) and Nader Masmoudi (NYU-Abu Dhabi) for their paper, "Inviscid Damping and the Asymptotic Stability of Planar Shear Flows in the 2D Euler Equations", *Publ. Math. Inst. Hautes Études Sci.* 122 (2015), 195–300. The selection committee recognized this work "for opening a broad new avenue of research, pioneering the rigorous approach to inviscid damping as a mechanism for stability in ideal flows." The prize committee members were: Milton C. Lopes Filho (Chair), Universidade Federal do Rio de Janeiro; Maria-Carme Calderer, University of Minnesota; Jonathan Mattingly, Duke University; Athanasios Tzavaras, King Abdullah University of Science and Technology; and Michael Weinstein, Columbia University.

SIAG/APDE plans to award the first SIAG/APDE Early Career Prize at the 2022 Berlin meeting. The initial proposal for this prize happened at PD15's Business Meeting. This prize will be awarded every two years to an early career researcher who has made outstanding, influential, and potentially long-lasting contributions within six years of receiving the PhD or equivalent degree as of January 1 of the award year. An additional requirement includes that at least one of the papers contains an English publication in a peer-reviewed journal or conference proceedings.

There is a mailing list to which members regularly post and receive information about conferences, summer schools, jobs and post-docs. The mailing list has quickly become an essential tool for the community.

The activity group maintains a website at http://siags.siam.org/siagapde/index.html

The website provides some general information about the activity group. The content is is organized in the following categories: Conferences, Jobs, Schools/REUs, News and Prizes. We gather submissions from the mailing list and manually post them onto the site. This website will

soon be replaced with the SIAM Engage platform. The new platform can integrate the website and mailing list functionalities, and also provide additional capabilities such as importing relevant material from other SIAM sources.

7. What activities are planned and proposed for the next period of the charter? Please describe scheduled and suggested future activities in detail.

- The next SIAM Conference on Analysis of Partial Differential Equations is being planned for March 14 to 18, 2022, at TU Berlin (Germany). The local organizers are Etienne Emmrich, Alexander Mielke, Marita Thomas, and Barbara Zwicknagl.
- We will award the first SIAG/APDE Early Career Prize at the 2022 Berlin meeting.
- The officers of this SIAG and the Editors of SIMA, Rob Lipton (Editor-in-Chief), Pierre-Emmanuel Jabin , Thanos Tzavaras from SIMA, are initiating a SIMA-SIAG APDE, launching the **S**eminar **I**n the **A**nalysis and **M**ethods of **PDE** (**SIAM PDE**) to be held on the **first Thursday of the month at 11:30am EDT**, except in January and August. The time will allow for a live audience in the US and Europe (e.g., 12pm EST). Exceptions could be made to accommodate audiences in Asia and Australia.

Preliminary discussions with the SIAM leadership were initiated on Thursday April 30th in a zoom meeting with Carol Woodward (VP-at-Large), Howard Elman (VP for Publications) and from SIAM there were Tim Fest, Nicole Gawel, and Richard Moore. Briefly, the current circumstances of social distancing call for online venues of research dissemination. The webinar will serve as a way to recognize achievements in our area and will be expected to help promoting the standing of both SIMA and APDE. These webinars will be beneficial to mathematicians that are in relatively isolated places. There is a proliferation now of online seminars, but we intend ours to distinguish ourselves in several ways and to continue well beyond this social distancing period.

Two type of webinars are envisioned:

(i) Colloquium-type webinars by very good speakers presenting a survey of results on a topic where critical progress was recently achieved (and not necessarily published in SIMA);

(ii) More focused seminar-like webinars based on some of the best articles accepted by SIMA.

One possibility is to hold six webinars per year of type (i) and six webinars of type (ii). For both (i) and (ii), speakers will be selected by an Organizing Committee (OC) of the webinar (rotating every two years). This committee will have 6 members, 3 appointed by SIMA and 3 by the SIAG APDE, taking into consideration gender and geographic diversity, as well as a broad covering of mathematical areas relevant to SIMA and to the Analysis of PDEs

The first OC is confirmed and has been approved by SIAM VP for Programs Jim Nagy and SIAM VP for Publications Howard Elman:

Gui-Qiang Chen (U. Oxford, UK)

Charlie Doering (U. Michigan)

Anna Mazzucato (Penn State)

Jim Nolen (Duke U.)

Helena Nussenzveig Lopes **(Chair)** (U. Federal do Rio de Janeiro, Brazil)

Eitan Tadmor (U. Maryland)

The OC has a two-year term, with appointments staggered against the term of the SIAG's officers. The next slate of officers of the SIAG has term January 1, 2021 till December 31, 2022. Those officers will appoint the next OC during the calendar year 2021, so the term of the next OC will be January 1st, 2022, till December 31st, 2023. The term of the current OC is from 05/19/2020 till December 31, 2021. Although this is less than 1 1/2 years, this OC needs to fill the seminar slots till May 2022 to give time to the next OC to get organized and start filling slots from June 2022 till May 2024.

The OC will be responsible for selecting/inviting speakers for the colloquium-type webinars (i), and designate a chair/host for each webinar who will introduce the speaker, and will moderate raised hands and Q&A. For (ii) the OC will coordinate with SIMA Editorial Board to develop a mechanism for selecting the articles and forwarding them to the committee (this has still to be decided). One possibility is that articles can be flagged by Editors, just as the review process is concluded, as being exceptional in aspects including novelty and impact. This would require an extra functionality in the SIMA online review website, which could be extended to other SIAM journals.

This webinar will be run by SIAM using their zoom license to engage large audiences:

https://siam.zoom.us/webinar/register/WN_wShvDipBQw6WafNN6QO5wg

Further, we plan to announce these webinars via a mailing list that includes the SIAG/APDE mailing list. The SIAG/APDE Secretary will manage this mailing list. Updated information and schedule will be available at http://siags.siam.org/siagapde/index.html until the new platform SIAM Engage goes live on July 2020.

Due to time constraints, the SIMA Editors and the SIAG/APDE officers have spearheaded this initiative selected the speakers for the June, July and September webinars. These speakers are:

Thursday June 4, 2020 - Sir John Ball (Heriot-Watt University, UK)

Title: *Some energy minimization problems for liquid crystals*

Thursday July 2, 2020 – To be confirmed.

Thursday September 3, 2020 - Felix Otto (Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany)

8. **How can SIAM help the activity group achieve its goals?**

Most of the SIAG/APDE community consists of academic members (92.1%). The poor representation of non-academic members is worrisome, and here SIAM could help to promote this activity group in non-academic institutions, such as industry and research labs. SIAM could also help establishing liaisons with international organizations with whom SIAM maintains reciprocal agreements. Many of these organizations have members with interests in line with those of the SIAG/APDE and, perhaps, a SIAG/APDE membership could be added as a free perk of Reciprocal Membership.

Also, SIAM should remind the new slate of officers about the expectations regarding organizing minisymposia and holding a track or co-locating at the SIAM Annual Meeting at least once every seven years.

9. How can the activity group help SIAM in its general role of promoting mathematics and computational science?

The SIAG/APDE contributes an analytical vision to SIAM that focuses on the interactions of rigorous analysis with modeling and scientific computing. It comprises a broad group of active research scientists, 92.1% of whom in academia, working towards understanding fundamental analytical issues for nonlinear models in the natural and social sciences. Applied mathematics relies on the synergy between rigorous analysis, computations and modeling and analysis of PDE is one of the classical areas where such synergy unfolds. Thus the SIAG/APDE community naturally plays a pivotal role in developing interdisciplinary research and fruitful collaborations among applied mathematicians.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2021.

Irene Fonseca (Chair),

May 16, 2020

Also on behalf of the SIAG/APDE Officers David Ambrose (Vice Chair), Jose Carrillo (Program Director), and Cleopatra Christoforou (Secretary)

Acknowledgment: We thank Timothy Fest and Nicole Gawel for their help in the preparation of this renewal application.